



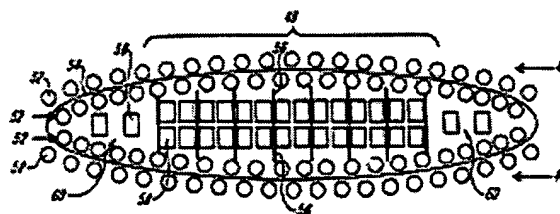


IMPROVED STRAP**Patent number:** WO9203603**Publication date:** 1992-03-05**Inventor:** PINKOS JOHN L [US]**Applicant:** ELIZABETH WEBBING MILLS CO INC [US]**Classification:****- international:** B32B23/02; B60R21/00; D03D11/00**- european:** D03D1/00A; D03D11/02**Application number:** WO1991US05777 19910815**Priority number(s):** US19900568270 19900815; US19910675293 19910326**Cited documents:**

	US4856837
	US4148957
	US4018960
	US4174738

Abstract of WO9203603

A novel woven webbing (40) having improved softness is provided. The webbing has a nontubular central region (46) and at least one filled tube (58) attached along the length of the central region and defining at least one edge (44, 45) of the webbing.



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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<p>(51) International Patent Classification ⁵ : D03D 11/00, B32B 23/02 B60R 21/00</p>	<p>A1</p>	<p>(11) International Publication Number: WO 92/03603 (43) International Publication Date: 5 March 1992 (05.03.92)</p>
<p>(21) International Application Number: PCT/US91/05777 (22) International Filing Date: 15 August 1991 (15.08.91) (30) Priority data: 568,270 15 August 1990 (15.08.90) US 675,293 26 March 1991 (26.03.91) US (71) Applicant: ELIZABETH WEBBING MILLS CO., INC. [US/US]; 521 Roosevelt Avenue, Central Falls, RI 02863 (US). (72) Inventor: PINKOS, John, L. ; 857 Putman Pike, Chepachet, RI 02814 (US). (74) Agent: GATES, Edward, R.; Wolf, Greenfield & Sacks, 600 Atlantic Avenue, Boston, MA 02210 (US).</p>		<p>(81) Designated States: AT, AT (European patent), AU, BB, BE (European patent), BF (OAPI patent), BG, BJ (OAPI patent), BR, CA, CF (OAPI patent), CG (OAPI patent), CH, CH (European patent), CI (OAPI patent), CM (OAPI patent), DE, DE (European patent), DK, DK (European patent), ES, ES (European patent), FI, FR (European patent), GA (OAPI patent), GB, GB (European patent), GN (OAPI patent), GR (European patent), HU, IT (European patent), JP, KP, KR, LK, LU, LU (European patent), MC, MG, ML (OAPI patent), MR (OAPI patent), MW, NL, NL (European patent), NO, RO, SD, SE, SE (European patent), SN (OAPI patent), SU*, TD (OAPI patent), TG (OAPI patent). Published With international search report.</p>
<p>(54) Title: IMPROVED STRAP</p> <div data-bbox="324 1239 1315 1617"></div> <p>(57) Abstract</p> <p>A novel woven webbing (40) having improved softness is provided. The webbing has a nontubular central region (46) and at least one filled tube (58) attached along the length of the central region and defining at least one edge (44, 45) of the webbing.</p>		

* See back of page

+ DESIGNATIONS OF "SU"

Any designation of "SU" has effect in the Russian Federation. It is not yet known whether any such designation has effect in other States of the former Soviet Union.

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IMPROVED STRAP

FIELD OF THE INVENTION

This invention relates generally to straps for restraining human beings, and more particularly to a woven strap having an improved tubular edge.

BACKGROUND OF THE INVENTION

Woven webbings have long been used as safety belts. Such belts are used with vehicles, including aircraft. Other fields of application include belts for climbers and also for engineers and craftsmen. Such webbings typically are one-ply and are formed with a conventional twill weave. A drawback of the conventional safety belts is that the edges are relatively stiff and tend to chaff the person wearing the belt.

An improved safety belt is described in U.S. patent 4,018,960. According to the '960 patent, the conventional safety belt is improved by providing rounded edges in the form of hollow, woven tubes.

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The tubes may be formed integrally with the belt portion, particularly in the form of a woven tube having weft threads in common with the belt portion. In this manner, according to the '960 patent, the undulating side edges of conventional belting which leads to chaffing are eliminated. U.S. patent 4,148,957 is directed to an improvement of the belting of the '960 patent, wherein the abrasion resistance of the tubular edges of the '960 patent is increased. U.S. patent 4,174,738 represents an improved method of manufacturing the belting of the '960 patent.

U.S. patent 4,600,626 relates to an improved seat belt having increased stiffness in the width-wise direction. The webbing of the '626 patent includes weft threads having both low bending stiffness and high bending stiffness. The weft threads of high bending stiffness being contained only in the central portion of the belt, but not in the selvedge portion. The webbing includes both a woven selvedge portion and a knitted selvedge portion, which are formed respectively along both side edges of the main portion. The woven selvedge portion forms a hollow selvedge with the first weft threads only. The hollow selvedge appears to be merely a by-product of the weaving process as it is not further discussed.

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The present invention involves an improvement to the known safety belt webbings having tubular edges. Accordingly, it is an object of the invention to provide an improved strap of woven webbing having edges which effectively resist abrasion and cutting.

Another object of the invention is to provide an improved strap of woven webbing having soft, flexible edges suitable for contact with a human or animal.

Another object of the invention is to provide a strap of woven webbing suitable for use as a seat belt, and particularly suitable for use with a child-seat.

Yet another object of the invention is to provide a strap of woven webbing having the foregoing properties which is simple and economical to manufacture.

SUMMARY OF THE INVENTION

These and other objects are achieved by the invention which provides a strip of woven material having resistance against cutting and abrading, while also having added softness along its edges thereby enhancing safety and comfort when the strip contacts humans or animals.

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According to one aspect of the invention, a length of woven material defines an edge relative to a central region, the edge being a filled, tubular edge and being adapted to deform when a force transverse to the length is applied to the edge. Preferably there are two, filled, tubular edges, and most preferably the two, tubular edges are separated by a one-ply, central region. The tube may be woven of the same material as the central region. The edges are constructed and arranged to be softer or more deformable than the central region between the edges. Surprisingly, even though the edges are softer or more deformable, the edges still have improved cut resistance as compared to conventional webbing.

According to another aspect of the invention, a method for making a strip of woven web material as defined above is provided. A tube is continuously woven from warp and weft fibers. The tube is flattened to form two plies and stuffer fibers are provided at the edges. The opposing plies then are bound to form a two-ply central region and at least one tubular region defining an edge containing the stuffer fibers.

According to yet another aspect of the invention, another method for making a strip of woven web material as defined above is provided.

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The strip is continuously woven from warp and weft fibers to provide a one-ply central region and a pair of tubular edges. Stuffer fibers are provided continuously and are located in a manner such that the tubes are woven to contain the stuffer fibers.

The invention also contemplates the use of the foregoing webbing as safety belts with related hardware such as buckles for seat belts and also with child seats of the type adapted to be removeably secured to a seat of a motor vehicle.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing objects and advantages of the present invention will be more clearly understood in connection with the accompanying drawings in which:

Fig. 1 is a perspective view of a strip of woven webbing material made according to the invention and held under tension with a force being applied transverse to the length;

Fig. 2 is a cross-sectional view taken along line 2-2 of the woven webbing of Fig. 1;

Fig. 3 is a sectional view taken along line 3-3 of the woven webbing of Fig. 1;

Fig. 4 is a perspective view of a child's automobile car seat embodying this invention;

Fig. 5 is a diagram of the chain draft for the

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weave according to Example I; and

Fig. 6 is a diagram of the loom draft for the weave according to Example I.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to Fig. 1, a woven webbing strap 40 according to the invention is shown under tension and with a force being applied transverse to the length of the strap 40. The force is applied by a knife 42. As can be seen, the edge 44 of the strap 40 deforms relative to the central region 46 when the knife 42 is contacted against the edge 44 using a force transverse to the length of the strap 40. This deformation allows the edge of the strap to 'give' under the force of the knife 42, thereby causing the edge 44 of the strap 40 to absorb some of the force of the contact with the knife 42. The cut resistance of the edge 44 is thus improved. At the same time, the edge is softer due to its ability to 'give' when a force is applied to the edge. Because the edge is softer, it is less likely to cut or injure a human or animal when the strap is under tension and is put to uses involving contact with human or animal skin (e.g., seat-belts, child restraints, harnesses).

Referring to Fig. 2, the woven strap 40 has an

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upper ply 48 and a lower ply 50. The upper and lower plies 48, 50 are formed of warp yarns 52 continuously woven with weft yarns 54. The upper and lower plies 48, 50 are bound together only along the central region 46 by binder yarns 56 in a conventional manner. The upper and lower plies are unbound along their periphery, thereby forming a pair of tubes 60 defining the opposing edges of the strap 40. Stuffer yarns 58 are sandwiched between the upper and lower plies 48, 50 and are bound in place in the central region 46 by the binder yarns 56. The stuffer yarns 58 also are contained in the tubes 60. They "float" freely in the tubes (Fig. 3). Tubes containing such stuffers are deemed to be "filled".

The stuffer yarns dramatically change the texture and feel of the tubular edges. The stuffer yarns add both bulk and roundness to the edges, and at the same time result in an edge that is softer. This overall result is particularly important when the webbing of the invention is used in child seats, where the webbing edges inevitably contact the sensitive skin (neck) of the child. This is to be distinguished from conventional uses where the belt typically contacts clothing, not skin.

The strap 40 can be formed by continuously weaving a tube from the warp yarns 52 and weft yarns

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54, and then flattening the tube to form a two-ply strap. Binder yarns 56 are woven continuously to bind the two plies to one another only in the central region 46 of the strap 40. The upper and lower plies 48, 50 of the strap 40 are not woven to one another by binder yarns 56 along their edges, and therefore a pair of tubes are formed along opposing edges 44, 45 of the strap 40. These tubes include the stuffer yarns 58, as well as other reinforcing or strengthening materials as desired. Virtually any material may be included in the tubes 60, ideally so long as that material does not significantly affect the ability of the edges to deform relative to the central region when a force is applied to the edges transverse to the length of the strap under tension. It will be understood, however, that if the tubes carry a strengthening material, the ability of the tubes to deform may be compromised somewhat. In this instance, certain benefits of the invention may not be achieved, although others will be achieved, and such embodiments are intended to be encompassed.

The strap 40 may be woven with conventional machinery used for manufacturing woven straps. Such machinery is well known to those of ordinary skill in the art and is commercially available. In essence, the prior art manufacturing technique may

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be followed, with the exception that the binder yarns which typically are present at the edges of a two-ply strap are removed so that a strap having filled tubes at opposing edges is formed.

The straps of the invention are particularly useful in situations where cut resistance is important. The improvement in cut resistance of the strap of the invention is surprising. The prior art approach to improving cut resistance was to add material to the edges and in particular add a stronger, reinforced material to the edges. According to the invention, material (binder) has been removed from the edges and the edges have been made in some respects weaker than the central region.

Although the preferred embodiment describes edges woven of the same material as the central region of the strap, the edges also may be woven of a different material.

The preferred strap according to this invention has a one-ply central region, not a two-ply central region. It is manufactured as described below.

Example I

Child Car Seat Strap

FIG. 4 shows a child's car seat 100 of the type adapted to be removably secured to a seat of a motor vehicle. The car seat 100 includes a pair of straps

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102 for restraining a child in the car seat. The straps 102 are attached through buckle 104 which may be releasably locked to the car seat 100. The straps 102 are 1 1/2 inch wide, having a central nontubular region and a pair of tubes woven lengthwise to this central region. The tubes have a width of 7/32 of an inch and the central nontubular region has a width of 1 1/16 of an inch. Thus, the tubes represent about 30% of the overall width (1 1/2") of the strap. The tubes are filled with 2850 denier Ansotex™, a bulked nylon obtained from Allied Signal, Petersburg, Virginia. The Ansotex™ floats freely in the tubes, each tube carrying six ends. The Ansotex™ nearly doubles the overall transverse thickness of the tube as compared to the transverse thickness of the tube without the Ansotex™ (0.083" vs. 0.045"). The weight per 100 yards is about 5.5 lbs., and the elongation is less than 20% at 700 lbs., and most preferably is about 7 1/2% at 700 lbs. The break strength is at least 1500 lbs., and most preferably is 2000 lbs.

The yarns were as follows: warp yarn was 840-Nylon; stuffer yarn was 2850 denier Ansotex™; weft yarn was 840-Nylon; and catch cord was 210-Nylon. All the yarns were one ply. The yarn strength was as follows: 8.3 grams/denier for the 840-Nylon; 5.5 grams/denier for the Ansotex™; and

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7.7 grams/denier for the 210-Nylon. The elongation at break for the 840-Nylon was 18% and for the 210-Nylon was 20%. The Nylon had a twist of 1/2 turn per inch.

The type of weave, which is shown in greater detail in the drawings, was as follows: the body-warp was a 2-2 twill weave and the tube-warp was a 3-1 regular weave. The stuffer was a 1-1 weave (floating loosely). The reed size for the loom was 14 Dents per inch and the reed type was M-2. The body contained 114 warped ends and the weft was 18 picks (finishes to 20 picks). The knitted edge had 38 warp ends and the opposite edge had 42 warp ends. Thus, the tubes utilize about 40% of the total warp ends in the strap. On a knitted edge, the needle catches only the catch cord, not the weft, with the filling wrapping itself around catch cord (in a normal edge, the needle catches both the filling and the catch cord). The edge was knitted using a Mueller Needle Latch Holder #846479, Mueller, Germany.

FIG. 5 is a diagram of the chain draft, with the harness number indicated on the horizontal axis and the gear number indicated on the vertical axis. This chain draft is appropriate for a ND-loom, Mueller, Germany. The X indicates "up pick" and the "." indicates "down pick". Referring to FIG. 8,

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harness 1 is skipped. Harnesses 2-5 show a 3-1 regular weave while harnesses 6-13 show a 2-2 twill weave. Harness 14 shows a 1-1 stuffer.

FIG. 6 shows the loom draft, the body portion indicated by bracket 106, the needle side tube indicated by bracket 108 and the opposite side tube indicated by bracket 110. The six within the circle indicates six ends of Ansotex™.

Prior to use, the woven product is dyed. The conditions for dyeing result in a certain amount of shrinkage of the final product and tightening of the fibers, which must be taken into account when manufacturing the product. Thus, the product as manufactured prior to dyeing is woven to be 1 3/4 inches wide, while the finished product is 1 1/2 inches wide.

The dye composition is as follows: 420 grams of Disperse Yellow 3, sold under the trade name Intrasperse Yellow GBA, Crompton Knowles, RI; 280 grams of Disperse Red 1, sold under the trade name Intrasperse Scarlet BRN, Crompton Knowles, RI; 1032 grams of Disperse Blue 3, sold under the trade name of Intrasperse Blue B, Compton Knowles, RI; 35 lbs. of a Polyacrylate sold under the trade name Cyanatex Polymer 660, Cynamide, NJ; 7 lbs. of Alkylaryl polyether alcohol, sold under the trade name Orcowet PA, Organic, RI; 11 lbs. of Ammonium Acetate,

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Gannon, RI; 1 lb., 12 oz. of Acetic Acid, Gannon, RI; and water sufficient to form a 350 gallon mix.

The treatment conditions were as follows: The manufactured product was introduced into a padder containing the dye mix. The dwell temperature was 90° F. and the dwell time was 4 seconds. There was a 40% pickup. The material was then run through a steamer at a temperature of 212° F. for 5 minutes in order to fix the dye. The material then was rinsed in a wash tank containing water at a temperature of 160° F. for 5 minutes to remove surface dye. The material then was dried in a hot air dryer at a temperature of 270° F. for 10 minutes to remove water. The tension that the material was subjected to during the foregoing treatment was determined by the speed at four different points in the process. The speed between the padder and steamer was 10.3 yds/min.; the speed between the steamer and wash tanks was 11.0 yds/min.; the speed between the tanks and the hot air dryer was 10.3 yds/min.; the speed after dying was 11.3 yds/min.

The foregoing weave also is useful in connection with seat belts for restraining a passenger in a vehicle. It will be understood by those of ordinary skill in the art, however, that the specific parameters of the weave will need to be varied to meet the safety requirements required for

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restraining an adult.

It should be apparent to those of ordinary skill in the art that various modifications and equivalents can be made without departing from the spirit or scope of the invention. The preceding description is meant to describe only a preferred embodiment and not to limit the scope of the invention.

What is claimed is:

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CLAIMS

1. In a safety belt of the type adapted to restrain or support a human being or animal and having a central nontubular region and at least one tubular edge attached lengthwise to and defining a first edge of the belt, the improvement comprising providing stuffer yarns in the tubular edge to form a first filled tube.

2. The improvement of claim 1 wherein the belt has a nontubular, two-ply central region.

3. The improvement of claim 2 wherein the belt has a nontubular, one-ply central region.

4. The improvement of claims 2 or 3 wherein the tube is constructed and arranged to deform relative to the central region when a transverse force is applied to the tube.

5. The improvement of claims 1-3 wherein the tube has a width of at least 1/8 of an inch.

6. The improvement of claims 1-3 wherein the tube has a width of about 7/32 of an inch.

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7. The improvement of claims 1-3 wherein the tube contains at least 6 stuffer yarns.

8. The improvement of claims 1-7 further comprising a second filled tube attached lengthwise to and defining a second edge of the strap.

9. The improvement of claim 8 wherein the tubes represent about 30% of the overall width of the strap.

10. The improvement of claim 9 wherein the belt is secured to a child seat adapted to be removeably secured to the seat of a motor vehicle.

11. The improvement of claim 9 wherein the belt is secured to a seat of a vehicle such as a motor vehicle, train or plane.

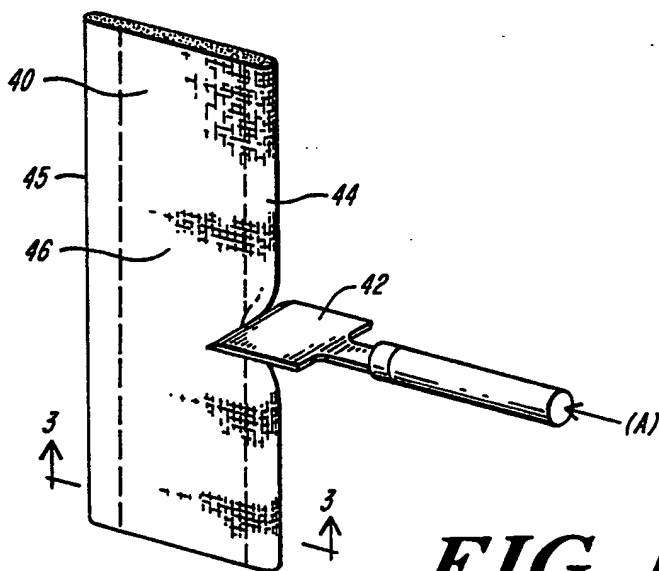


FIG. 1

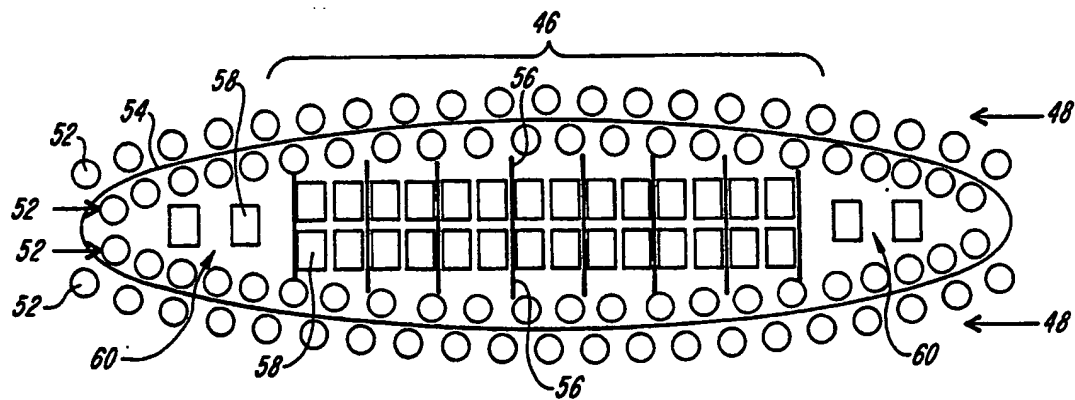


FIG. 2

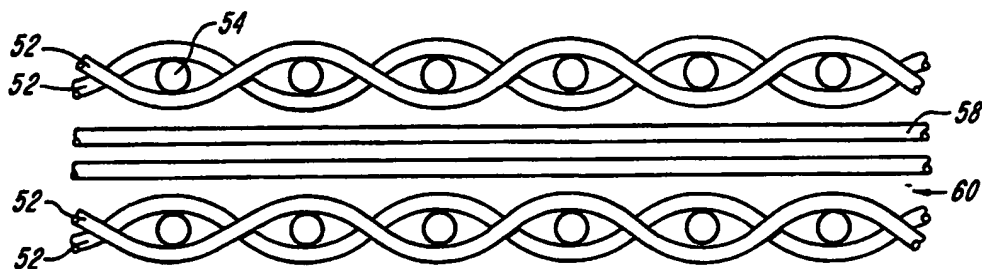


FIG. 3

SUBSTITUTE SHEET

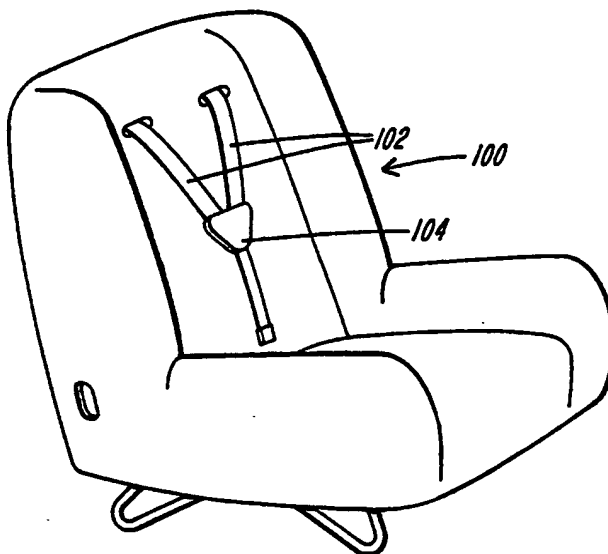


FIG. 4

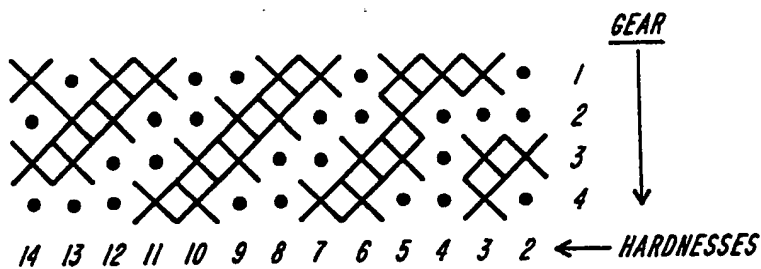


FIG. 5

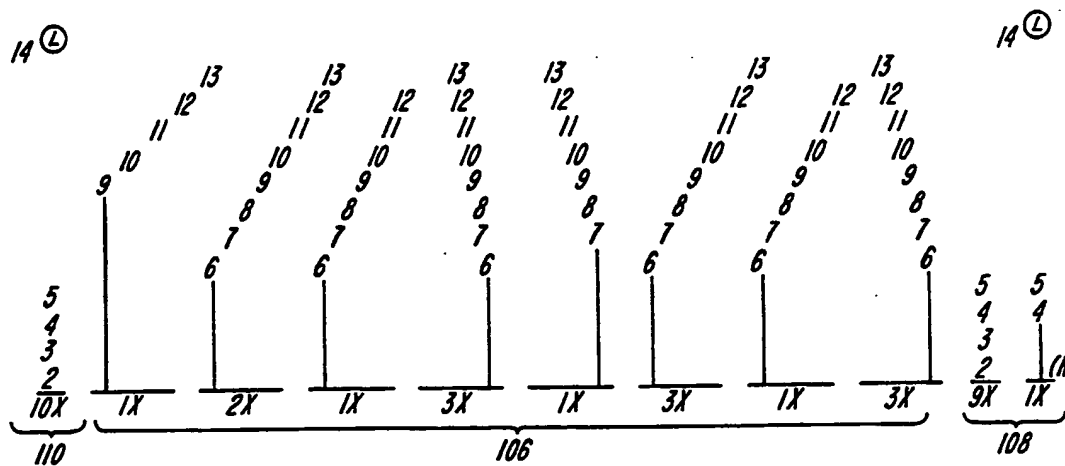


FIG. 6

INTERNATIONAL SEARCH REPORT

PCT/US91/05777

International Application No

I. CLASSIFICATION OF SUBJECT MATTER (If several classification symbols apply, indicate all) ¹		
According to International Patent Classification (IPC) or to both National Classification and IPC		
IPC (5): D03D 11/00; B32B 23/02; B60R 21/00		
U.S. Cl.: 428/193; 294/74; 180/268; 139/411		
II. FIELDS SEARCHED		
Minimum Documentation Searched ⁴		
Classification System ¹	Classification Symbols	
U.S.	428/193; 294/74; 139/411, 383, 384R, 387R; 57/201; 180/268	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched ⁵		
III. DOCUMENTS CONSIDERED TO BE RELEVANT ¹⁴		
Category ⁶	Citation of Document, ¹⁰ with indication, where appropriate, of the relevant passages ¹⁷	Relevant to Claim No. ¹⁴
X	US, A, 4,856,837 (HAMMERSLA, JR.) 15 AUGUST 1989; See the Figures.	1-4
X	US, A, 4,148,957 (BERGER ET AL) 10 APRIL 1979; See column 2.	1-4
X	US, A, 4,018,960 (BERGER ET AL) 19 APRIL 1977; See Figure 7.	1-4
X	US, A, 4,174,738 (BERGER ET AL) 20 NOVEMBER 1979; See the Figures.	1-4
<p>⁷ Special categories of cited documents: ¹³</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"Δ" document member of the same patent family</p>		
IV. CERTIFICATION		
Date of the Actual Completion of the International Search ⁸	Date of Mailing of this International Search Report ⁹	
22 October 1991	12 NOV 1991	
International Searching Authority ¹	Signature of Authorized Officer ²⁰	
TSA/US	Charles R. Nold	

FURTHER INFORMATION CONTINUED FROM THE SECOND SHEET

V. ☐ OBSERVATIONS WHERE CERTAIN CLAIMS WERE FOUND UNSEARCHABLE¹

This international search report has not been established in respect of certain claims under Article 17(2) (a) for the following reasons:

1. ☐ Claim numbers _____, because they relate to subject matter¹ not required to be searched by this Authority, namely:

2. ☐ Claim numbers _____, because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out¹, specifically:

3. ☒ Claim numbers 5 - 11 because they are dependent claims not drafted in accordance with the second and third sentences of PCT Rule 6.4(a).

VI. ☐ OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING²

This International Searching Authority found multiple inventions in this international application as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims of the international application.
2. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims of the international application for which fees were paid, specifically claims:
3. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claim numbers:
4. ☐ As all searchable claims could be searched without effort justifying an additional fee, the International Searching Authority did not invite payment of any additional fee.

Remark on Protest

- ☐ The additional search fees were accompanied by applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.